DIRECTORATE FOR ENGINEERING

MEMORANDUM

DATE: Tuesday, October 05, 2004

TO: The 2004 Civil and Mechanical Systems Committee of Visitors (CoV)

CC: Kristina M. Johnson, Chair of the Engineering Advisory Committee
Bruce Hamilton, Acting Deputy Assistant Director for Engineering
A. Galip Ulsoy, Division Director for Civil and Mechanical Systems (CMS)

FROM: John Brighton, Assistant Director for Engineering

SUBJECT: Charge to the CMS CoV

Thank you for agreeing to serve on the Committee of Visitors (CoV) for the Division of Civil and Mechanical Systems (CMS) of the Engineering Directorate of the National Science Foundation (NSF). By NSF policy, programs that award grants or cooperative agreements are reviewed at three-year intervals by a CoV. The CoV is an ad hoc subcommittee of the Advisory Committee for the Directorate for Engineering, and Dr. Thomas O'Rourke, who will serve as the CoV Chair, and Dr. James Bernard, who will serve as the Co-Chair, are both members of the Advisory Committee. The purpose of the CoV is to assess program-level technical and managerial matters pertaining to program decisions.

The CoV is charged to address:

- The integrity, efficacy, and quality of the processes used to solicit, review, recommend and document proposal actions and monitor active projects;
- The quality and significance of the results of the Division's programmatic investments;
- The degree to which the award process supports the long-range goals and core strategies of the NSF as described in **NSF FY 2003-2008 Strategic Plan** (September 30, 2003) that addresses the **Government Performance and Results Act of 1993** (GPRA). These documents and other background on GPRA may be found at http://www.nsf.gov/od/gpra/start.htm. A framework for addressing this issue will be provided at the time of the COV meeting;
- The Division's balance, priorities, and future directions; and,
- Any other issues you think are relevant to the review.

This CMS CoV shall use the attached Core Questions and Report Template in preparing its report (see enclosure).

Decisions to award or decline grant proposals are based on the informed judgment of program officers and division directors following merit review. Systematic examination of proposal files by qualified external parties provides an independent mechanism of monitoring and evaluating the quality and pertinence of proposal decisions. This examination is part of the job of the CoV.

The review will assess the operations of the Division of Civil and Mechanical Systems in fiscal years 2001, 2002, and 2003, as they support the Foundation's goals regarding **people, ideas and tools**. The CoV will examine a sample of files for both awarded and declined proposals in each program. The activities of the CMS Division are organized into five programs: (1) Dynamic System Modeling, Sensing and Control (DSMSC), (2) Geotechnical and GeoHazards Systems (GHS), (3) Infrastructure and Information

April 14, 2004

Kristina Johnson, Dean
Pratt School of Engineering
305 Teer Building
Box 90271
Duke University
Durham, NC 27708

RE: Committee of Visitors Report for the Division of Civil and Mechanical Systems (CMS)

Dear Dr. Johnson:

Enclosed, please find a revised Committee of Visitors (COV) report for the Division of Civil and Mechanical Systems (CMS) in the Directorate of Engineering at the National Science Foundation (NSF) and cover letter, dated 14 April 2004.

This report should replace the one dated 7 April 2004. The initial report does not benefit from the input and clarifications of some COV members, which were received after it was mailed to you. The enclosed report properly reflects the views of all COV members and should be received and used as the final COV report for CMS.

We regret any inconvenience associated with this change. We are pleased, however, to submit a document that embodies the consensus assessment of the COV and provides a solid foundation for CMS evaluation and future directions.

Sincerely,

T. D. O'Rourke
Committee Chair
Thomas R. Briggs Professor of Engineering
Cornell University

J. E. Bernard
Committee Co-Chair
Anson Marston Distinguished Professor of Engineering
Iowa State University

CC Galip Ulsoy and John Brighton

April 14, 2004

Kristina Johnson, Dean
Pratt School of Engineering
305 Teer Building
Box 90271
Duke University
Durham, NC 27708

RE: Committee of Visitors Report for the Division of Civil and Mechanical Systems (CMS)

Dear Dr. Johnson:

Attached please find the Committee of Visitors (COV) report for the Division of Civil and Mechanical Systems (CMS) in the Directorate of Engineering at the National Science Foundation (NSF).

The report is based on the COV visit that took place on March 22-24, 2004 at NSF. The visit began with oral briefings by the Division Director of CMS and the Program Directors. The Committee then examined over 112 randomly selected jackets, reviewed proposal actions and funding statistics, and discussed in closed and open meetings issues of importance to CMS.

CMS is home for five research programs: Dynamic System Modeling, Sensing and Control, Solid Mechanics and Materials Engineering, Structural Systems and Engineering, Geotechnical and GeoHazards Engineering, and Infrastructure and Information Systems. CMS also manages one Major Research Equipment and Facilities Construction project: the George E. Brown, Jr. Network for Earthquake Engineering Simulation. The COV developed a separate section of its report to address NEES, which is located after Part B in the attached document.

Overall, the COV finds that the CMS Division is doing a very good job in managing its programs. The Division has been successful in helping the Foundation to achieve desirable outcomes in its investments in people, ideas, and tools. In the spirit of continuous improvement, the COV identified several areas for future attention.

On behalf of the COV, we would like to thank the Division Director, Galip Ulsoy, and the Program Directors: Perumalsamy N. Balaguru, Ken P. Chong, Yip-Wah Chung, Jesus M. De La Garza, Richard J. Fragaszy, Jorn Larsen-Basse, Shih-Chi Liu, Steven L.

McCabe, Vilas Mujumdar, Joy M. Pauschke, Juan M. Pestana-Nascimento, Masayoshi Tomizuka, and Dennis Wenger. We also appreciate and thank the CMS staff. All CMS personnel were exceptionally helpful and responsive.

Please feel free to contact us if you have questions concerning the report.

Sincerely,

T. D. O'Rourke
Committee Chair
Thomas R. Briggs Professor of Engineering
Cornell University

J. E. Bernard
Committee Co-Chair
Anson Marston Distinguished Professor of Engineering
Iowa State University

CC Galip Ulsoy and John Brighton

Report

Committee of Visitors
Civil and Mechanical Systems Division
Directorate of Engineering
National Science Foundation
March 22, 23, and 24

Submitted to

Dr. Kristina M. Johnson
Chair
Engineering Advisory Committee
National Science Foundation

Committee Members

Tom O'Rourke, (Chair), Cornell University

Jim Bernard, (Co-chair), Iowa State University

Harry Asada, Massachusetts Institute of Technology

Ted Belytschko, Northwestern University

Shirley Dyke, Washington University

Silvia Ferrari, Duke University

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Marshall Jones, GE Global Research

Edward Kavazanjian, Jr., University of Southern California

Peter May, University of Washington

Sue McNeil, University of Illinois, Chicago

Horace Moo-Young, Lehigh University

Glaucio Paulino, University of Illinois, Urbana

Jocelyn Seng, Owens Corning and Air Force Research Laboratory

Sharon Wood, University of Texas at Austin

Executive Summary

The Committee of Visitors of the Civil and Mechanical Systems (CMS) Division met on March 22-24, 2004 to review programs for fiscal years 2001, 2002, and 2003. The charge to the committee included a review of the integrity, efficacy and quality of the processes for proposal actions and monitoring active projects; the quality and significance of the results of the Division's programmatic investments; the degree to which the award process supports the long-range goals and core strategies of NSF; the divisions balance, priorities, and future directions; and other issues the COV determines to be relevant.

The visit began with oral briefings by the Division Director of CMS and the Program Directors in the Division. The Committee then examined 112 randomly selected jackets (including 56 awards and 56 declinations), plus additional jackets that were provided as requested by COV members during the review. The Committee reviewed proposal actions and funding statistics, and discussed issues of importance to CMS in closed and open meetings.

The COV finds the Division to be effective in assuring the integrity and achieving efficiency in its program processes and management. Proposals selected for funding are of high quality. In spite of continuing increases in the number of proposals handled, average dwell time has decreased to less than six months. It is an average 5.4 months, which is an excellent record.

The documentation in the jackets is very good. CMS uses the panel review process, supplemented with mail reviews. This process has been implemented effectively and fairly, and a good distribution of reviewers has been achieved in terms of geographic location, gender, and minority representation. Likewise, the CMS portfolio of funded projects has an appropriate distribution in terms of geography, gender, and minority representation.

The use of the broader impacts criterion improved over the three-year period of COV evaluation. The reviewers now appear to be cognizant of the importance of broader impacts and use the criterion in their assessments. The interpretation of the meaning of broad impact varies significantly among the panels. It is therefore desirable to seek a more consistent understanding and application of the criterion in future panel reviews.

In general, it was difficult to assess the expertise and qualifications of reviewers on the basis of the information provided in the jackets. The COV recommends that reviewers be asked to provide short biographical sketches, and that this information be included in the jackets.

The COV judges that CMS has been successful in meeting the outcome goals in people, ideas, and tools. Specific examples illustrating the Division's success in each of these areas are given in the report.

The Program Directors are commended for supporting first time researchers. Approximately 30% of CMS funding has been directed to first time researchers, thus providing the entrance and experience base for those seeking careers with a strong component of research. Especially noteworthy is CMS support of CAREER awards, which constitute about 50% of the funding for first time researches, or 15% of the research portfolio.

The COV notes that about half of CMS funding is pre-committed to research initiatives and other mandated projects, or "fenced". Combined with budget reductions, the net result is that the success rate for proposals within the CMS core competencies may fall to less than 10% for FY 2004. We advise carefully monitoring the ratio of fenced funds to total funds to ensure enough funds remain available for flexible use. We recommend that a proper balance be maintained between fenced initiatives and the funding of core competencies.

To meet the challenge of increasing numbers of proposals, the COV recommends that additional staff be assigned to CMS at both the PD and support staff levels. Additional funds are also sorely needed to support the many worthy projects that are proposed, but unable to be funded. The COV recognizes significant increases in funding may not be available in the near term. Therefore, it may be necessary to deal with increasing proposal loads under the assumption of relatively flat funding. Options include, but are not limited to, restricting the number of proposals from a single PI and readjusting the levels of support provided for various activities.

The George E. Brown, Jr. Network for Earthquake Engineering Research (NEES) should be a top priority at the division, directorate, and upper management levels of NSF. This project provides the opportunity to explore the use of the cyberinfrastructure in its application to geographically distributed experimental facilities for cost-effective investments in large scale experimentation through shared-use facilities and experiments and more efficient utilization of major research equipment. NEES also provides unique opportunities with respect to database management and retrieval, advanced computational modeling, and linkage with the research, academic, industrial, and K-12 communities. It involves not only significant technical challenges, but entails social and cultural challenges as members of the civil engineering and computer science communities work together at an unprecedented level of collaboration. The potential payoff is very high. Much can be learned and applied from NEES that is relevant to future projects at NSF. It is in the interest of all to ensure the success of NEES.

Large-scale research programs such as NEES place a heavy burden on NSF professional and support staff. It is vital that PDs have adequate resources to perform their work effectively. In particular, they should receive the necessary travel assistance to visit equipment and research sites on a regular basis, and to maintain close contact with key individuals within the research and user communities.

It appears that resources are not sufficient within CMS and the Engineering Directorate to realize the full potential of NEES. Furthermore, funds will be reallocated from other programs at the division and directorate levels just to support NEES with a resource base significantly below its capabilities. The COV does not believe that NEES should drain resources from other programs in CMS and the Engineering Directorate. Because of the importance of this project for NSF, the COV strongly recommends exploring with NSF upper management ways to obtain additional funds for NEES as a supplement to the Engineering Directorate budget.

There is an excellent opportunity for CMS to take a continuing lead role in developing and directing NSF research in the area of homeland security. The Division has distinguished itself to date by undertaking a major research effort on the effects of September 11, 2001, which culminated in a special publication and press conference dealing with the research results. The COV recommends that CMS pursue research on homeland security issues and continue to pursue leadership position in this area.

It would be advantageous to have a mechanism for division-level strategic advice. The COV is not well suited to this mission. Its charge is to assess program-level technical and managerial matters pertaining to program decisions. Moreover, the advice provided by the Engineering Advisory Committee to the Engineering Directorate is generally at a strategic level that addresses cross-cutting divisional issues and areas of broader NSF policy. The COV therefore recommends that consideration be given to establishing a division-level advisory committee composed of external experts from universities, industry, and government. It is likely that this recommendation applies to other divisions as well.

PART A. INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged. Please do not take time to answer questions if they do not apply to the program.

A.1 Questions about the quality and effectiveness of the program's use of merit review procedures.

Provide comments in the space below the question**.** Discuss areas of concern in the space provided.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
Is the review mechanism appropriate? (panels, ad hoc reviews, site visits) Comments: The principal review mechanism for CMS is the review panel. Proposal evaluations were made either by a panel or a combination of panel and mail reviews. The panels were generally well organized. The COV finds that the panel review process is appropriate. It allows for a relatively rapid evaluation of proposals, which is an important attribute given the large numbers of proposals processed by CMS. A panel also provides the opportunity to bring junior members of the research community into contact with established researchers and practitioners. Panels promote networking among junior and senior researchers. They help junior members of the community obtain insights about the preparation of proposals and review standards. The panel review process, however, can be biased against unusual proposals and lesser-known researchers. It is therefore imperative for PDs to continue to encourage reviewers to remain receptive to new ideas and technologies.	**YES**

Is the review process efficient and effective? Comments: The panel review process is efficient. As stated above, the process is effective in handling a large number of proposals in a fair and objective way. The COV notes that the panel process may be the only way to deal effectively with the large numbers of proposals that must be processed yearly by CMS. Panel reviews are biased to seek consensus, which may overlook or de-emphasize high-risk, high-potential payoff projects. It is important, therefore, for PDs to remind reviewers of the need to consider high-risk projects in their assessments. At the same time, it is important for CMS to develop a balanced portfolio of projects with a certain proportion of high-risk investigations, as discussed in forthcoming sections of the report.	**YES**
Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines? Comments: Reviewers were sensitive and responsive to special solicitations.	**YES**
Do the individual reviews (either mail or panel) provide sufficient information for the principal investigator(s) to understand the basis for the reviewer's recommendation? Comments: Most of the individual reviews provide sufficient information for the principal investigators to understand the basis for the reviewers' recommendations. Many of them are solid and informative reviews. In some cases, the reviews consisted of just a few lines, but these types of review appeared to be a relatively small percentage of the total that were examined by the COV.	**YES**
Do the panel summaries provide sufficient information for the principal investigator(s) to understand the basis for the panel recommendation? Comments: In general, the panel summaries provided a reasonable overview of the discussions during the review, addressing both the technical merits and the broader impacts of the research.	**YES**

Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation? Comments: In general the documentation is very good. For most cases, the information appears to be complete and consistent with the panel information.	**YES**
Is the time to decision appropriate? Comments The COV finds that CMS has performed in an exemplary manner with respect to rapid and effective processing of proposals under demanding conditions that involve consistent, yearly increases in the numbers of proposals. CMS should be commended. Average dwell time has decreased to less than six months. The overall average dwell time is 5.4 months, according to statistics provided by CMS. This is a very good record, and especially noteworthy given the increasing number of proposals that have been processed in recent years.	**YES**
Discuss issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures: In most cases, the merit review procedures are very successful at identifying high quality proposals.	

A.2 Questions concerning the implementation of the NSF Merit Review Criteria (intellectual merit and broader impacts) by reviewers and program officers.
Provide comments in the space below the question. Discuss issues or concerns in the space provided.

IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
Have the individual reviews (either mail or panel) addressed whether the proposal contributes to both merit review criteria? Comments: The use of the broader impacts criterion improved over the three-year period of this evaluation. The reviewers now appear to be cognizant of the importance of broader impacts, but they do not necessarily weigh that criterion as heavily as intellectual merit. Since a project needs to be grounded in an intellectually meritorious activity for it to have appropriate broader impacts, a bias towards the intellectual merit criterion is both understandable and a sensible basis for decisions. The COV notes that the interpretation of the meaning of broad impact seems to vary among panels. This again is understandable because each panel has a unique composition, and its decision-making will vary according to composition. Nevertheless, it is desirable to seek a more consistent understanding and application of the broader impacts criterion. This consistency should be achievable with continued vigilance on the part of the PDs in providing examples and guiding panels in applying the broader impacts criterion.	**YES**
Have the panel summary reviews addressed whether the proposal contributes to both merit review criteria? Comments: The panel summaries now typically address both merit review criteria.	**YES**
Have the *review analyses* (Form 7s) addressed whether the proposal contributes to both merit review criteria? Comments: Review analyses now typically address both merit review criteria.	**YES**

Discuss any issues or concerns the COV has identified with respect to NSF's merit review system.

A.3 Questions concerning the selection of reviewers. Provide comments in the space below the question. Discuss areas of concern in the space provided.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
Did the program make use of an adequate number of reviewers for a balanced review? Comments: In most cases, four panelists reviewed each proposal, and the entire panel participated in the discussions. Given the very high proposal load, this appears to be a reasonable number.	**YES**
Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: It appears that the program directors have considered technical expertise when assigning panelists. However, there is not sufficient information in the jackets for the COV to confirm this observation. A good remedial step would be to ask the reviewers to provide a short biographical sketch with their reviews. The biographical information would be included in the jackets.	**Not Enough Data Available**
Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups? Comments: The geographic distribution was good. CMS did a laudable job of implementing the 2001 COV recommendations for involving non-academic reviewers. Most panels included women and underrepresented minorities.	**YES**

Did the program recognize and resolve conflicts of interest when appropriate? Comments: Conflicts of interest were noted in the program folders, and panelists with conflicts did not participate in the discussions.	**YES**
Discuss any concerns identified that are relevant to selection of reviewers.	

A.4 Questions concerning the resulting portfolio of awards under review. Provide comments in the space below the question. Discuss areas of concern in the space provided.

RESULTING PORTFOLIO OF AWARDS	**APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE**
Overall quality of the research and/or education projects supported by the program. Comments: The overall quality of the research and education projects is very high.	**Appropriate**
Are awards appropriate in size and duration for the scope of the projects? Comments: The size of the typical award is relatively modest, and in most cases insufficient to support experimental research at a significant scale. Given budget constraints and the number of high quality proposals, the size of awards appears to be a reasonable compromise.	**Appropriate**

Does the program portfolio have an appropriate balance of: • High Risk Proposals? Comments: Typically in CMS, high risk proposals are funded through the SGER process. The funding limit on SEGRs has been increased recently to $200,000, which appears adequate to engage in some substantive high-risk projects. However, the increasing numbers of proposals in the face of flat, and even declining, budgets means that the opportunities to utilize the SEGRs is, in turn, constrained. It should be noted that CMS manages NEES, which is as a high-risk, high-opportunity program. The risk is balanced by the pioneering aspects of the program, which involve experimental sites interactively engaged and accessible by worldwide users though high performance Internet. The system will allow co-synchronous physical and computational simulation at geographically dispersed sites. Its success depends on intense collaboration among civil and mechanical engineers and IT specialists.	**Appropriate**
Does the program portfolio have an appropriate balance of: • Multidisciplinary Proposals? Comments: CMS is involved in interdisciplinary research with HUD, USDOT, SANDIA, and DOE. It also works with BES, SBE (DRMS) and engages in initiatives in biocomplexity, sensors, information technology, and nanoscience.	**Appropriate**
Does the program portfolio have an appropriate balance of: • Innovative Proposals? Comments: The 112 jackets sampled by the COV did not provide sufficient information to draw a conclusion.	**Not Enough Data Available**
Does the program portfolio have an appropriate balance of: • Funding for centers, groups and awards to individuals? Comments: The CMS portfolio is a reasonable mix of awards to groups and individuals.	**Appropriate**

Does the program portfolio have an appropriate balance of: • Awards to new investigators? Comments: The CMS portfolio has an appropriate balance of awards to new investigators, who receive 30% of the awards. This includes substantial support for CAREER proposals (approximately 50% of the support for new investigators, or 15% of the CMS portfolio).	**Appropriate**
Does the program portfolio have an appropriate balance of: • Geographical distribution of Principal Investigators? Comments: The CMS portfolio has an appropriate geographical distribution of PIs.	**Appropriate**
Does the program portfolio have an appropriate balance of: • Institutional types? Comments: The program portfolio appears to have an appropriate balance of institutions. Consistent with NSF guidelines, 40% of MRIs were awarded to non-PhD-granting institutions. There is evidence of awards to EPSCoR, PUI and minority institutions.	**Appropriate**
Does the program portfolio have an appropriate balance of: • Projects that integrate research and education? Comments: Some proposals have a very strong educational component integrated with research. As a result of the broader impact criterion, recently successful proposals tend to have a fairly significant educational component. Supplements are often used to fund educational activities.	**Appropriate**
Does the program portfolio have an appropriate balance: • Across disciplines and sub-disciplines of the activity and of emerging opportunities? Comments: The 112 jackets sampled by the COV did not provide sufficient information to draw a conclusion.	**Not Enough Data Available**
Does the program portfolio have appropriate participation of underrepresented groups? Comments: The program has appropriately funded underrepresented groups.	**Appropriate**

Is the program relevant to national priorities, agency mission, relevant fields and other customer needs? Include citations of relevant external reports. Comments: The CMS program is highly relevant to national priorities, agency mission, and relevant fields, During the period of 2001-2003, CMS has supported the development and publication of more that 50 national reports and national/international proceedings to identify and focus on new research directions. Some reports were developed by the National Research Council. Others were developed by external organizations that assembled diverse, representative groups to summarize priorities for various research and practicing communities. Ample evidence of relevant external studies and guidance documents were provided by CMS when requested by the COV. The list of reports cited below are examples of the types of studies engaged by CMS to guide and focus its selection of projects relevant to national priorities and relevant fields: • National Research Council. *Preventing Earthquake Disasters - A Research Agenda for the Network for Earthquake Engineering Simulation (NEES)*. Committee to Develop a Long-Term Research Agenda for the Network for Earthquake Engineering Simulation. Board on Infrastructure and the Constructed Environment Division on Engineering and Physical Sciences. The National Academies Press. Washington, DC, 2003 • NSF National Sensors Workshop Report (Aug 2001 Lake Tahoe) • Proceedings US-Korea Workshop on Smart Infrastructural Systems, 23-24 August 2002, Busan, Korea. • Control for Fuel Cells Workshop, University of California, Irvine, CA, April 3-4, 2003. • NSF Workshop on Future Directions in Nano-Scale Systems, Dynamics and Control, Metin Sitti (ed.), NanoRobotics Laboratory, Department of Mechanical Engineering and the Robotics Institute, Carnegie Mellon University, Pittsburgh, PA. • R. Shoureshi (ed.), *Proceedings of the ESF-NSF Workshop on Advancing Technological Frontiers for Feasibility of Ageless Structures,* in press. • Mita and B.F. Spencer, Jr. (eds.), *Proceedings of the International Workshop on Advanced Sensors, Structural Health Monitoring, and Smart Structures*.	**Appropriate**

• Digital Infrastructures: Enabling Civil and Environmental Systems through Information Technology, edited by Rae Zimmerman, ICIS, New York University and Thomas A. Horan, Claremont Graduate University, Routledge, September 2004. • *Beyond September 11th: An Account of Post-Disaster Research*, (2003). Book, Published, Editor(s): Natural Hazards Research & Applications Information Center, Public Entity Risk Institute, and Institute for Civil Infrastructure Systems, Collection: University of Colorado-Boulder Special Publications Series, Bibliography: Special Publication #39. Boulder, CO: University of Colorado • Responding to the Unexpected, NSF Workshop, New York, N.Y. February 27 – March 1, 2002. • NSF Summer Institute on Nanomechanics and Materials, Northwestern University, Evanston, IL, August 11-15, 2003. • NSF Workshop on Nano- and Micro-Mechanics of Solids for Emerging Science and Technology, Kyung-Suk Kim, Brown University • *Future Research Directions in Solid Mechanics*, Am. Academy of Mechanics, PI: Francis Moon, July 2003. • EERI. *Securing Society Against Catastrophic Earthquake Losses - A Research and Outreach Plan in Earthquake Engineering*. Earthquake Engineering Research Institute. Richmond, CA, 2003.	

Discuss any concerns identified that are relevant to the quality of the projects or the balance of the portfolio.

The quality of the projects is excellent, but the available resources do not allow funding of many worthy projects. As CMS has engaged in an increasing number of initiatives in recent years, there has been an increasing larger proportion of its portfolio invested in fenced projects, i.e. projects that are pre-committed in PD budgets to initiatives outside CMS programs. The percentage of fenced projects for 2005 is projected to exceed 50% of the CMS portfolio.

The COV is very concerned that the increasing number of fenced projects threatens the balance in the CMS research portfolio. The COV believes that attention should be directed to emerging and multidisciplinary areas, but not at the expense of being overly restrictive of core programs. It is important to recognize that innovation is not just synonymous with emerging technology, but often is a key attribute of research in core disciplines. It is critical, therefore, to support research that stimulates innovation and breakthroughs in core programs. The COV recommends that a proper balance be maintained between fenced initiatives and the funding of core competencies.

A.5 Management of the program under review. Please comment on:

Management of the program.
Comments:

The current PDs are doing an excellent job of managing the program. Proposals are reviewed in a timely manner. The review panels include a variety of junior and senior researchers. Given the funding constraints, the portfolio of projects is well balanced.

Responsiveness of the program to emerging research and education trends.
Comments:

The PDs have been responsive to NSF initiatives. There has been participation in NSF priority areas, such as ADVANCE (Advance Participation of Women in Science and Engineering), ITR (Information Technology Research), BE (Bio-complexity in the Environment), NSE (Nanoscale Science and Technology), and HSD (Human and Social Dynamics). CMS is engaged in Engineering Directorate initiatives, such as Sensors and Sensor Networks. CMS initiatives and priorities include NEES Research.

Program planning and prioritization process (internal and external) that guided the development of the portfolio u under review.
Comments:

The PDs have responded well to internal and external pressures in establishing priorities and developing a portfolio of projects.

Discuss any concerns identified that are relevant to the management of the program.

The COV notes that the number of proposals that CMS handles continues to rise in an environment where the number the Division currently handles threatens to overload the system. Furthermore, there has been a significant decrease in the unfenced funds available for unsolicited proposals. Success rates for unsolicited proposals may fall to less than 10% in CMS for FY 2004. This decrease in funding rate threatens the sustainability of the unsolicited proposal program. Moreover, this is threatening on two additional counts. On the one hand, as the success rates go down and the chances of funding diminish, a lowering of morale and consequent loss of influence in the technical community may result. On the other hand, PDs are losing time to handle the very important non-administrative part of their duties (e.g., developing new research directions, mentoring young faculty, participating in workshops and conferences, and collaboration with other research agencies) again potentially leading to lowering of morale and loss of influence. The obvious remedy, increased resources for both personnel and for research funding, may not be available in the near term. This situation calls for consideration of alternate measures – taking steps to limit the number of proposals to be considered and giving very high priority to adding program officers and support staff.

B.1 OUTCOME GOAL for PEOPLE: Developing "a diverse, competitive and globally engaged workforce of scientists, engineers, technologists and well-prepared citizens."

Comments:

CMS is attentive to the NSF strategic goal of developing "a diverse, competitive, and globally engaged workforce of scientists, engineers, technologists and well-prepared citizens." The emphasis on this goal is articulated by: (1) the use of CAREER, REU, and other NSF-funding mechanisms to promote education and diversity, (2) funding of innovative activities that specifically support this objective, (3) program solicitation and panel review with appropriate emphasis on the people, and (4) encouragement of a diverse and globally involved CMS PD workforce. As a whole, our impression is that the "people" objective is taken very seriously within CMS and the record with respect to it is very strong. As important is the observation that the CMS culture of PDs and review processes has institutionalized attention to these considerations providing some assurance that the strong record will continue.

The traditional mechanisms for promoting development of new researchers at NSF are the CAREER, REU, and IGERT mechanisms. CMS maintains strong involvement with the first two, with a total of 66 CAREER awards during FY 2001-2003, comprising some 15% of the CMS total budget. Twenty percent of these went to women PIs and 13.6 % went to PIs from under-represented minority groups. CMS PDs have promoted the REU mechanism among the relevant research communities with substantial PI involvement (284 projects in FY 2001 – FY 2003 had REUs). There has been much less involvement with the IGERT program for which PDs from CMS have virtually no control.

CMS has funded projects aimed at developing a diverse research community, involving new researchers, and extending international connections. Two examples stand out:

- A series of "Workshops for Faculty Diversity in Civil and Mechanical Engineering" have been funded over the past eight years (most recently, CMS-0305673, PI-Mattei, University of New Orleans) to bring together faculty and doctoral students from under-represented groups to encourage a more diverse research community.
- A more focused activity aimed at encouraging new researchers to enter the field of hazards research is the "Enabling Project" (CMS-0218413, PI-Burby, University of North Carolina). This project involves mentoring of 16 assistant professors, many of whom are outside the hazards field, about research opportunities and development of research proposals.

More generally, CMS has been effective in promoting international collaboration through funding international workshops over the past three years and in funding projects that specifically involve such collaboration. One example is the funding of a series of US-Japan workshops (most recently CMS 0244365, PI-Tubbesing, Earthquake Engineering Research Institute) that involve sharing research findings among American and Japanese researchers.

An example of support for training in emerging technologies is the program of Professor Liu at Northwestern University (CMS 0318907). This program supports two classes each summer that train approximately 100 professors, post-docs, graduate students, and industry participants in the fundamentals of nanotechnology.

The PDs have done an excellent job integrating educational objectives into their research programs through funding for PUIs and K-12 initiatives. For example, support of the MRI proposal of Ruggles (CMS 0215809) will greatly impact a PUI, and improve undergraduate research.

NEES is intended to provide an environment for education and training not only for graduate students, but at the undergraduate and K-12 levels. The groundwork has been laid for a strong training and education component that will be integrated with future research projects.

Emphasis on "people" issues was evident in our examination of external reviews, panel deliberations, and PD recommendations. The positive outcomes of this emphasis are evident from statistics about CMS proposals and funding for underrepresented groups relative to the Engineering Directorate as a whole. For FY 2001-2003, an average of 10.7 % of proposals were from females (11.7 % ENG wide), 4.9 % from Hispanic PI's (3.5 % ENG wide), and 2.2 % from Afro-American PI's (2.9 % ENG wide). These percentages can be put in context with recognition that in 2002, 9.2 % of engineering faculty were women, 3.1 % were Hispanic, and 2 % were Afro-American (American Society for Engineering Education, 2002).

Compared to the CMS-wide success ratio of 14.3% for FY 2001-2003, the success ratio for female PIs was 19.7%, Hispanic PIs 18%, and Afro-American PIs 20.7 %. These success ratios demonstrate a commitment within the review process to support a diverse research community.

The issues of diversity also carry over to the composition of the CMS PD workforce. Diversity here is important, given the visibility of PDs in their respective research communities. For FY 2001-2003, more than one-quarter of the PD staff were women.

Three areas for potential improvement related to the people objective were discussed within the COV and with PDs. One involves more attention to the IGERT mechanism for encouraging the development of innovative, multi-disciplinary graduate training programs of relevance to CMS. The obvious constraint here is the limited ability of CMS personnel to affect the flow and review of IGERT proposals. A second area is the extent to which CMS is stressing international collaboration and connections, particularly given the realization of the strength of research in CMS-related programs in a number of other countries. While CMS does support international collaboration, it would be advantageous for such funding to increase in the future. The third is the tendency of PIs to present boilerplate responses to the integration of research and education. While it is common for individual proposals to fund and involve graduate and undergraduate (through REU) students, proposals could also explore less conventional activities that involve high school teachers, access to K-12 students, and collaboration with science museums. PIs should be strongly encouraged to review representative activities at the NSF website (http://www.nsf.gov/pubs/2002/nsf022/bicexamples.pdf) that satisfy the requirements of broader impacts.

B.2 OUTCOME GOAL for IDEAS: Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society."

Comments:

All CMS programs are making a strong contribution in the way of new ideas and the implementation of those ideas. Examples are given below for each program.

Solid Mechanics and Materials Engineering (SMME)

- CMS0239130 (Shaofan Li, UC-Berkeley) CAREER proposal exploring the linkage between nanoscale and microscale behavior (using the quasi-continuum model and the handshake approach) with meshfree computational techniques, which is quite creative and interesting.
- CMS0115954 (Glaucio Paulino, UIUC) "for a major study of the mechanics of functionally graded materials" (extracted from the Annual Report for FY2001, Mechanics and Materials Engineering Program, CMS Division).
- CMS0338438 (Pipes, Akron) SGER to investigate carbon nanotube polyimide microsensors by micro raman spectroscopy. High risk research funding
- CMS 0324601 (Weaver, Alabama Tuscaloosa) to study dendrimer-based nanocomposites for tribological applications. Novel contribution to nano-research.
- CMS0335390 (Wong, North Dakota) SGER to investigate cost-effective substitutes for carbon nanotubes and other nanocomposites. High-risk seed grant on nano-science.
- CMS0324461 (Subhash, Michigan Tech) GOALI to investigate ultrafine grained and nanostructured ceramics (influence of processing, grain size and strain rate on fracture). Example of integration of academia and industry contributions.
- CMS0310596 (Shephard, RPI) for Multiscale Systems Engineering. This is a research center on novel developments of multiscale and nanosystems involving advanced modeling concepts and data structures.

Infrastructure and Information Systems (ISS)

The ISS programs have produced both short and long term impacts through discovery and innovation. The SGER mechanism for funding projects related to the World Trade Center collapse was critical to developing concepts related to blast effects and fire, understanding the economic impacts of catastrophic events, and collecting data on building performance.

Other innovative ideas relate to the use of sensors and visualization in construction. Laser scanning and embedded sensors are used on construction sites to identify construction defects (Akinci –CMS 0121549). This includes inspection planning, object recognition algorithms, design representation and formalisms for defect detection. Similarly, visualization using animated 3D worlds, is used for project control (Martinez – CMS 0113890). The 3D animation language allows people to navigate and immerse themselves in a virtual world.

Dynamic System Modeling, Sensing and Control (DSMSC)

CMS-0201386 (T. Iwasaki, University of Virginia) "Dynamic Interaction between Mechanical Rectifier Biological Oscillator." This proposal tackled a very tough problem in control theory from a biology standpoint. Integration of adaptive control and robust control has been an open question, which is

difficult to address based on the control theory currently available. The PI proposed innovative control architecture inspired by biological systems, i.e. animal locomotion. In animal locomotion, robust control and adaptive control co-exist, and are highly integrated. This research has already made a significant breakthrough, and the PI has formed an interdisciplinary research group based on the NSF funding.

Geotechnical and Geohazards Engineering (GGE)

Innovative projects with high potential include:

CMS-0092447- (Schaefer) This proposal investigated a novel technology for landslide assessment using laser swath mapping.

CMS-0234009 This action supported fundamental research in the modeling of soil liquefaction within a general thermodynamic framework. The project has the potential for a true breakthrough by providing a comprehensive basis for modeling the transition of liquefied soil from a solid-like to fluid-like state during an earthquake.

Structural Systems and Engineering (SSE)

CMS-0220006 – Study of Tornado-Induced Wind Loads on Built Structures
The project combines engineers with expertise in fluid-structure interaction and scientists with expertise in meteorology, and provides a mechanism for integrating computational and experimental simulations of structural systems with data measured during severe storms. Each year, more than 800 tornados occur in the US, which cause on average 80 deaths, 1500 injuries, and $850 million in damage. The research is focused on quantifying tornadic wind loads on structures, which is the first step to improving the safety of the infrastructure.

CMS -0215808 – Acquisition of Instrumentation for Development of Reliable Technologies for Harsh Environments
As part of this Major Research Instrumentation award, facilities were developed to evaluate the reliability of new technologies for use in harsh environments. The award complements a NASA Grand Challenge Award at the University of Idaho, and will investigate the use of MEMS in space. MEMS are expected to revolutionize instruments used for aerospace applications due to their small size and weight.

B.3 OUTCOME GOAL for TOOLS: Providing "broadly accessible, state-of-the-art S&E facilities, tools and other infrastructure that enable discovery, learning and innovation."

TOOLS Strategic Outcome Goal: Providing broadly accessible, state-of-the-art information-bases and shared research and education tools

Within the limits of their funding, CMS programs are quite successful in providing tools for the research community. Significant examples are discussed under the following headings:

a. George E. Brown, Jr Network for Earthquake Engineering Simulation (NEES)

NEES is a major research equipment and facilities construction project, to be completed in October 2004. It creates a national, geographically-distributed infrastructure for earthquake engineering research and education, in which equipment sites and users and linked through

high performance Internet and specially designed network software packages. This system promises to revolutionize the field of earthquake engineering. It also provides an example of how to develop collaboratories in other divisions of the Engineering Directorate as well as other directorates of NSF. NEES is discussed in greater detail in a separate section of this document.

b. Major Research Initiative (MRI)

Approximately 10 of 30 proposals for the acquisition of research equipment were funded by CMS in 2003. This is a significantly higher success ratio than CMS overall, which was 15% in 2003. The procedure for allocating funding is quite involved. Proposals in the million dollar range are in a separate category and the final selection from a pool is made by the overall NSF administration. Of the smaller proposals, 40% of the funded proposals are aimed at colleges that focus on undergraduate education. In 2003 CMS contributed $350K to help fund a directional random wave generator for Texas A&M (total cost = $800 K).

Many of the successful proposals address both the need of the equipment for research and its potential for undergraduate or K-12 education.

Examples of outstanding contributions to tools for information services and data exchange and for technology in widespread use to improve the quality of life include:

- Natural Hazards Research and Applications Information Center at the University of Boulder Colorado (CMS 0354424, CMS 0301156). The center serves as a national and international clearinghouse for research data on natural disasters, related technological events, and programs to reduce damage. It provides not just data, but also serves as the place “to go to” (a nexus and facilitator) for data and resources related to natural hazards. The center awards travel grants to social scientists for “quick response” studies, disseminates both web-based and hard copy information, and provides dissertation grants. The center also conducts an annual workshop. Its bimonthly newsletter is mailed to over 15,000 subscribers. Some of the hazards are non-traditional, such as debris collection from the space shuttle Columbia. The Center also supports REU students.
- Magnetic Resonance Imagery (CMS-8008629) PI: P.C. Lauterbur, SUNY at Stoneybrook. Research on this technology was funded in the 1980s to refine nuclear magnetic resonance into a routine diagnostic technique. In 2002, over 20,000 such machines were used by health care facilities worldwide, with more than 60 million examinations using the technology. For his contributions, Prof. Lauterbur won the 2003 Nobel Prize in Medicine.

B.4 <u>OUTCOME GOAL for ORGANIZATIONAL EXCELLENCE</u>: Providing “an agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices.”

E-jackets are used extensively in CMS, with electronic handling of almost the entire proposal-servicing process. From the point of view of the supply side, Fastlane is now a well-accepted practice.

As described elsewhere, CMS has decreased the average proposal dwell time to 5.4 months. From 2000 to 2003 the number of proposals processed by CMS has increased by nearly 50%.

George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES)

Overview

NEES is a unique program within CMS. Great care has been taken to meet the special needs of this large integrated program. The bottom line is that the program is working very effectively and is achieving its objectives.

Review Process

A two-stage review process has been developed for the equipment site proposals that could be used as a model for other large-scale projects. Initial reviews are conducted by Technical Panels. Based on the results of this review, a set of proposals is selected for stage-two review. In the second stage, selected PIs are invited to respond to the results of the initial review and to present their proposals to a Portfolio Panel. This Portfolio Panel makes final recommendations on the rating and ranking of proposals. After the second stage review, the Program Directors make the final funding decisions.

This two-stage review process has worked well. The examined jackets showed that the review decisions were fair and well documented. Major decisions were supported by the panel recommendations. This approach is recommended for other large-scale programs within CMS. In particular, the model should be considered for large NEESR projects.

Management of Projects

NSF management has had to deal with difficult personnel issues. The handling of these problems has been performed with integrity and professionalism. To deal with such issues, it has been necessary that the PDs take an active involvement in the program.

Challenges

There will always be challenges for the management of a major research program such as NEES, including:

- Judging and documenting “close calls” between very similar high priority proposals.
- Identification of review panelists that provide both breadth and depth of understanding.
- Providing a clear charge to panels while still allowing flexibility in proposal evaluation.
- Providing clear instructions to second stage PIs

- Integrating the results of different panels that might have different standards for review of proposals.
- Developing appropriate metrics for the initial evaluation of proposals and for monitoring objectives, especially when these objectives evolve over time.

Program Directors have dealt with these challenges. Future projects of similar scale and scope (e.g. cyberinfrastructure efforts) will require concerted PD involvement in collaboration with the research community.

Broader Impacts

Regarding the broader impacts, NEES has the potential to revolutionize the field of earthquake engineering. Thus, training, education and outreach need to be integrated into NEES activities. The equipment sites have proposed varying levels of education and training programs. It is too early to determine the effectiveness of the use of sites as an instrument for training, so it is not yet clear whether each institution is currently meeting its obligations regarding the implementation of training plans. Quarterly reports refer to activities, such as attending workshops to reach out to potential users. However, activities discussed in proposals may not be discussed further in annual reports. This raises questions about the commitment to training and education. The NEES Consortium operational team will have personnel responsible for this area, but the source of the funding for these activities will have to be outside of CMS. To achieve the full promise of NEES, additional funding could be directed toward these activities, possibly through establishing partnerships with other programs at NSF and elsewhere that focus on education and outreach.

Other Issues

External Advisory Boards can play an important positive role in large-scale research projects. They need to be viewed by PIs as an asset, not a liability.

Large-scale research programs such as NEES place a heavy burden on NSF professional and support staff. It is vital that PDs have adequate resources to perform their work effectively. In particular, they should receive the necessary travel assistance to visit equipment and research sites on a regular basis, and to maintain close contact with key individuals within the research and user communities.

NEES involves not only significant technical challenges, but entails significant social and cultural challenges as members of the civil engineering and computer science communities work together at an unprecedented level of collaboration. Research involving the social science community about how NEES addresses these challenges and the broader management of engineering technology is appropriate for NSF funding as part of the NEES program.

Outcomes

People. The education of the next generation of earthquake engineers to utilize effectively the tools provided by NEES is an important outcome. The Consortium Development team is developing a plan for these activities and the equipment sites are currently developing training materials.

Ideas. The NEES program is one of the first to generate a cyberinfrastructure for a particular discipline. This asset and the lessons learned throughout this program will be very useful to other communities of researchers who are or will be involved in similar efforts.

Tools. A major NEES outcome will be the establishment of a collection of equipment sites, connected by high-speed internet with the possibility of remote use and collaboration through telepresence and centralized data repository. This effort will result in a highly innovative virtual tool with capabilities beyond anything that has been established to date. The Consortium Development is on schedule, and the equipment sites are expected to meet the deadlines set forth. The System Integration effort faces many challenges. It is making progress with strong involvement and guidance from the PDs and Associate Directors for the program.

PART C. OTHER TOPICS

C.1 Please comment on any program areas in need of improvement or gaps (if any) within program areas.

It would be advantageous to have a mechanism for division-level strategic advice. The COV is not well suited to this mission. Its charge is to assess program-level technical and managerial matters pertaining to program decisions. Moreover, the review and advice provided by the Engineering Advisory Committee to the Engineering Directorate are generally at a strategic level that addresses cross-cutting divisional issues and areas of broader NSF policy. Hence, there appears to be a gap and corresponding opportunity with respect to division-level guidance. The COV therefore recommends that consideration be given to establishing a division-level advisory committee composed of external experts from universities, industry, and government. It is likely that this recommendation applies to other divisions as well.

C.2 Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

The COV notes that use of "nuggets" is important in conveying the successes of NSF-sponsored research to Congress and other stakeholders. Considering the importance of nuggets, it is advisable for PDs and PIs to improve the ways of collecting and editing them so that their clarity and quality are enhanced. We recommend that guidance and

examples be provided to PIs so they can explain the significance of their research and its relevance with respect to the public.

C.3 Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

The George E. Brown, Jr. Network for Earthquake Engineering Research (NEES) should be a top priority at the division, directorate, and central management levels of NSF. This project provides the opportunity to explore the use of the cyberinfrastructure in its application to geographically distributed experimental facilities for cost-effective investments in large scale experimentation through shared-use facilities and experiments and more efficient utilization of major research equipment. NEES also provides unique opportunities with respect to database management and retrieval, advanced computational modeling, and linkage with the research, academic, industrial, and K-12 communities. It involves not only significant technical challenges, but entails significant social and cultural challenges as members of the civil engineering and computer science communities work together at an unprecedented level of collaboration. The potential payoff is very high. Much can be learned and applied from NEES that is relevant to future projects at NSF. It is in the interest of all to ensure the success of NEES.

Currently, support of NEES requires that financial resources be reallocated from other programs within CMS and other divisions within the Engineering Directorate. Operations, maintenance, and management (OM&M) of NEES require approximately $20 million/yr. Approximately $9 million/yr is being invested by NSF in research projects that use NEES, which is less than half the OM&M cost. An NRC study, which was commissioned to provide guidance on NEES, recommended that $40 million/yr would be an appropriate level of investment in NEES research projects (National Research Council, 2003). The first solicitation for research projects using NEES (NEESR) generated 115 proposals. It is estimated that the research budget only provides for about a 5% success rate for these proposals.

It appears that resources are not sufficient within CMS and the Engineering Directorate to realize the full potential of NEES. Furthermore, funds will be reallocated from other programs at the division and directorate levels just to support NEES with a resource base significantly below its capabilities. The COV does not believe that NEES should drain resources from other programs in CMS and the Engineering Directorate. Because of the importance of this project for NSF, we strongly recommend exploring with upper level NSF management ways to obtain additional funds for NEES as a supplement to the Engineering Directorate budget.

We note that about half of CMS funding is pre-committed to research initiatives and other mandated projects, or fenced. We appreciate that this is a complicated topic subject to pressures from many constituencies. We advise carefully monitoring the ratio

of fenced funds to total funds with a view toward being sure enough funds remain available for flexible use. We recommend that a proper balance be maintained between fenced initiatives and the funding of core competencies.

C.4 Please provide comments on any other issues the COV feels are relevant.

There is an excellent opportunity for CMS to take a continuing lead role in developing and directing NSF research in the area of homeland security. The Division has distinguished itself to date by undertaking a major research effort on the effects of September 11, 2001, which culminated in a special publication and press conference dealing with the research results. It is the COV understanding that NSF is currently in discussion with the Department of Homeland Security (DHS) regarding joint research activities. We recommend that CMS pursue research on homeland security issues and renew its leadership position in this area.

CMS is facing a growing challenge with the increasing number of proposals that are submitted for review by division PDs. This situation creates significant pressures. With the funding for the programs remaining static (or even declining), success rates are diminishing. The success rate for CMS is currently 15%, the lowest in the Engineering Directorate, and approximately one third lower that the average NSF success rate. If the number of proposals continues to increase, the success rate will continue to go down. Current funding levels for unsolicited proposals is such that the success rate within CMS for them in FY2004 is likely to be less than 10%. At the same time, the proposal load per PD (not including NEES PDs) has increased dramatically from approximately 100 per year to about 140 per year since 2000. In addition, the PD load also includes handling each about 140 supplements per year.

To meet the challenge of increasing numbers of proposals, we recommend that additional staff be assigned to CMS at both the PD and support staff levels. Additional funds are also sorely needed to support the many worthy projects that are proposed, but unable to be funded. The COV recognizes that the need for additional money is expressed by virtually every division within NSF, and that substantial increases in funding are not likely in the near term. Therefore, it is necessary to deal with the increasing proposal loads under the assumption of relatively flat funding. Options include, but are not be limited to, restricting the number of proposals from a single PI, readjusting the levels of support provided for various activities, etc. As discussed earlier, a division-level advisory committee could be very helpful in choosing the most appropriate options and in planning future CMS activities.

In recommending that options be explored for reallocating resources to support more worthy proposals, the COV affirms its support of unsolicited proposals. We believe that the support of unsolicited proposals by NSF is a significant, and perhaps unique, strength that should be preserved in developing the CMS portfolio of sponsored research.

C.5 NSF would appreciate your comments on how to improve the COV review process, format and report template.

The time allotted for the COV involved two days, beginning Monday, 22 March at 1:00pm and ending Wednesday, 24 March at approximately noon. There is too much information to digest and required interaction among the COV and the NSF staff to comfortably produce a quality report in this period of time. Three days would be better.

In addition, it appears to us that there are too many questions to address in the template under section A. If the volume of material in this section, which is in large part related to time consuming accounting, could be reduced, the COV could spend more time on substantive issues. As a minimum, the template should be designed to ask the most important questions first within each subdivision of Section A. External committees are inclined to address questions in order of their appearance. Very lengthy and detailed sections, such as A.4, receive disproportionate attention to the initial questions, leaving insufficient time and concentration for what the COV regards as the more important questions at the end of the section.

If detailed questions related to quantities and proportions of funds required for appropriate portfolio balance remain in future templates, then statistics specific to the questions should be developed in advance and shared with the COV. The COV can then discuss whether the statistics represent an appropriate balance, and perform an approximate check on that balance with the limited number of jackets and time available for evaluation.

The template provided to future COVs should be absolutely clean and free of previous changes and variations in formatting rules. It should be as flexible and adaptive as possible.

National Research Council. *Preventing Earthquake Disasters - A Research Agenda for the Network for Earthquake Engineering Simulation (NEES)*. Committee to Develop a Long-Term Research Agenda for the Network for Earthquake Engineering Simulation. Board on Infrastructure and the Constructed Environment Division on Engineering and Physical Sciences. The National Academies Press. Washington, DC, 2003

Systems (IIS), (4) Solid Mechanics and Materials Engineering (SMME), (5) Structural Systems and Engineering (SSE). The CMS Division also has responsibility for the Major Research Equipment and Facilities Construction (MREFC) project Network for Earthquake Engineering Simulation (NEES).

The meeting of the CMS CoV will take place on Monday through Wednesday, March 22-24, 2004, at the National Science Foundation located at 4201 Wilson Boulevard, Arlington, Virginia. The CoV will convene at 1:00pm on Monday 3/22, in Room 530, and will adjourn at noon on Wednesday 3/24.

The CoV should transmit its report, addressing the charge, to Dr. Kristina Johnson, Chair of the Engineering Advisory Committee, for its review by **April 7, 2004**. Dr. Johnson will forward the report to me with any comments that the Engineering Advisory Committee may have. In accordance with NSF policy, I will provide a response setting forth any actions to be taken on each suggestion or recommendation. Both the CoV report and my response will be forwarded to the Director of the NSF.

Attachments: Core Questions and Report Template
2004 CMS Committee of Visitors' Biosketches

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October 5, 2004

TO: Kristina Johnson
Chair ENG Advisory Committee

FROM: John Brighton
Assistant Director, ENG

SUBJECT: Report on Diversity, Independence, Balance and the Resolution of Conflicts for the CMS CoV

This is my report to you, as the Chair of the Advisory Committee for the Engineering Directorate, on the diversity, independence and balance of the Committee of Visitors (CoV) for the Division of Civil and Mechanical Systems (CMS) held during March 22-24, 2004.

The Committee of Visitors, which was assembled to review the CMS Division, and whose report was presented to the Engineering Advisory Committee on May 20, 2004, consisted of sixteen persons, of whom eleven are male and five are female. Two of the members of the committee are African-American and one is Hispanic.

Thirteen members of the CoV are from academia, Dr. Jones is from industry, Dr. Anderson is from the federal government and Dr. Seng is from both the Federal Government and industry. Also, Dr. Kavazanjian spent most of his career as a consultant before recently becoming a Research Professor at the University of Southern California, and several CoV members from academia have extensive industrial consulting experience. The CoV Chair is a Civil Engineer, and the Co-Chair a Mechanical Engineer. The members represent all relevant areas of civil and mechanical engineering (e.g., mechanics, materials, structures, geotechnical, environmental, dynamics, control), and include one member from political science and one member from urban planning. All invited CoV members attended the meeting, except Dr. Gary Anderson, who had to cancel at the last minute due to a family emergency.

Most of the academics are full professors, however, the members do include an associate professor and an assistant professor. Four are members of the National Academy of Engineering (Belytschko, Iwan, Jones, O'Rourke).

Four members (Ferrari, Seng, Jones, Anderson) have neither been applicants to CMS in the past five years nor served as ENG Advisory Committee members. Most are familiar with CMS, from having served on the ENG Advisory Committee, on a previous CoV, review panels or are former grantees. A conflict of interest briefing was held on the first day of the CoV visit. The absence of any conflict of interest was confirmed by asking all to complete the NSF Conflict of Interest form, none of which disclosed any conflicts that could not be resolved. Assignments were made to ensure that there would be no conflicts of interest. No real or apparent conflicts arose during the course of the meeting that had to be resolved.